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# Work absence following road traffic crash in Victoria, Australia: A population-based study

Shannon E. Gray[a,b,*], Alex Collie[a,b]

[a] Insurance Work and Health Group, School of Public Health and Preventive Medicine, Monash University, Australia
[b] Centre for Research Excellence in Recovery Following Road Traffic Injuries, Australia

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ABSTRACT

*Introduction:* Road traffic crash (RTC) burden is typically reported using hospitalisations or fatalities, yet alternative measures such as work absence provide further insight into RTC impacts. This study aimed to quantify work absence due to compensable RTCs in Victoria, and to determine the characteristics associated with prolonged work absence.
*Methods:* In Victoria, Australia, two systems provide income support whilst unable to work, among other benefits, to those injured during RTCs either at work (workers' compensation: WC) or elsewhere (RTC compensation). Administrative data of accepted claims between July 1 2003 and June 30, 2013 were included from working age people (15–65 years) if at least one day of income support was paid. Total time (in weeks) on income support, and hence absent from work, was calculated for each person and for each predictor (age group, sex, compensation system, length of hospital stay, injury type and road user type). Cox regression was used to determine the likelihood of prolonged work absence by predictor, presented as hazard ratios (HR) with 95% confidence intervals.
*Results:* For 36,640 injured people, 1,121,863 weeks were compensated (median 10 weeks). Median work absence was shortest among those involved in a train/tram crash (2.9 weeks, HR:0.57[0.51-0.64]) and those with contusions/abrasions (3.7 weeks, HR:0.66[0.64,0.69]). Median work absence was longest among those with spinal cord injury (115.9 weeks, HR:1.56[1.26,1.92]) or severe acquired brain injury (129.6 weeks, HR:1.60[1.44,1.77]). Work absence likelihood increased with length of hospital stay. Median work absence was similar between compensation systems (WC: 10.1 weeks, RTC: 10.0 weeks) yet likelihood of greater work absence was higher in the RTC compensation system (HR:1.12[1.08,1.17]).
*Conclusions:* Work absence is both a measureable and important metric for assessing the impact of RTC injury in those working at the time of injury. Work absence was at least ten weeks for more than half of all injured persons, reinforcing need for road safety, injury prevention, and return to work services. Furthermore, this study identified those most at risk of prolonged work absence, providing the opportunity to target specific individuals to develop strategies to reduce work absence, such as occupation-specific rehabilitation or graduated return to work.



## Introduction

The impact of road traffic crashes (RTCs) is typically reported using fatality and hospitalisation statistics [1,2] or estimates of quality of life such as disability adjusted life years [3]. Reductions in these statistics are generally associated with improved safety [3,4]. However, these statistics underestimate the true burden of RTCs as they generally fail to account for non-fatal and less severe injuries that are known to cause significant economic and human costs (e.g. quality of life) [5,6]. Alternative measures may provide further insight into the full impacts of RTC in society and may include, for instance, how injury affects participation in employment among working age people.

Work absence can be detrimental to the long-term health of an injured person [5,7]. Worklessness has been associated with higher mortality, poorer physical and mental health, higher health service use, and higher likelihood of chronic conditions [7]. Additionally, long periods of work absence after RTC can result in loss of pre-injury skills and declined self-confidence and self-efficacy [8,9]. Furthermore, work absence due to (any) injury has also been associated with increased risk of marital separation [10] and negative effects on family members' health [11].

* Corresponding author at: 553 St Kilda Rd, Melbourne, 3004, Australia.
*E-mail address:* Shannon.gray@monash.edu (S.E. Gray).

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Work absence due to RTCs in the state of Victoria, Australia, in 2003 was estimated to have cost $536.4 million (AUD) due to workplace disruption and loss of labour in the workforce [12]. Employers bear substantial costs, for example absenteeism (habitual work absence), lost productivity or output, temporary or permanent replacement of a worker, and recruitment and retraining costs [9]. Unlike employers, injured people may be financially supported for their work absence during recovery by an injury compensation scheme. However, these often have limits on the amount of time they will provide compensation benefits, leading some of those injured to rely on social insurance systems, which adversely affects society [8].

Conversely, work is known to be beneficial to wellbeing and physical and mental health, as well as being an important determinant of health by indicating function [7,13]. During recovery from injury, it is often necessary to be absent from work, however there is increasing evidence to suggest that returning to the workforce is important for rehabilitation and can assist recovery [7,13,14]. Returning to work has been found to be therapeutic and reduces the risk of long-term incapacity by promoting participation in society [7]. Because the likelihood of return to work decreases with more time spent absent from work [14], it is important to identify those most at risk of prolonged work absence to enable preventive measures.

To our knowledge, there have been no population-based studies of work absence following RTC injury. Prior studies of working age adults involved in RTC have assumed all of those injured to be working at the time of their injury if within the typical working age bracket [5,12]. Further, no studies have sought to describe the amount of work absence by subgroups such as nature of injury, age group, or gender. Understanding work absence in these subgroups can help identify who is absent from work and work absence duration, and better define the population and individual level impacts of RTC. This information may assist the development of more targeted interventions to reduce work absence and its societal, employer and personal impacts. The aims of this study are to quantify work absence due to compensable RTCs in the state of Victoria, Australia, and to determine the characteristics associated with prolonged work absence.

**Table 1**
Selection criteria and road user group classification.

| Workers' compensation | | | Merged dataset | Road traffic crash compensation system | | |
|---|---|---|---|---|---|---|
| Mechanism of injury | | Agency of injury | Road user group | Claimant role | | Vehicle insurance class |
| Vehicle accident Rollover | & | Trucks, semi-trailers, lorries | Heavy goods vehicles | Driver/ Passenger | & | Goods vehicles:<br>up to two tonnes capacity<br>two tonnes capacity<br>prime mover type vehicle<br>owned by primary producer |
| Vehicle accident Rollover | & | Buses, trolleybuses, minibuses | Buses | Driver/ Passenger | & | Passenger vehicles:<br>bus seating fewer than 10 people including the driver<br>bus seating more than 9 but fewer than 31 people including the driver<br>bus seating 31 people or more |
| Vehicle accident Rollover | & | Cars, station wages, vans, utilities | Cars | Driver/ Passenger | & | Passenger vehicles:<br>sedan, station wagon or related body-type<br>seating fewer than 10 people including the driver<br>seating more than 9 people including the driver<br>taxi licenced under the transport act 1983 |
| Vehicle accident Rollover | & | Motorcycles, sidecars and scooters | Motorcycles/ scooters | Motorcyclist | | |
| Vehicle accident Rollover | & | Pushbikes | Cyclists | Cyclist | | |
| Vehicle accident Rollover | & | Railway, tramway lines (track and other fixtures)<br>Locomotives<br>Rolling stock<br>Trains<br>Other rail transport | Trains/ trams | Train/tram | | |
| Vehicle accident Rollover | & | Tractors, agricultural or otherwise<br>All-terrain vehicle<br>Trailbike<br>Other road transport | Off-road vehicles | Driver/ Passenger/ Motorcyclist | & | Miscellaneous motor vehicles:<br>any tractor, self-propelled farm machine owned by primary producer |
| Vehicle accident Rollover | & | Other transport<br>Wet, oily or icy traffic and ground surfaces<br>Traffic and ground surfaces with hazardous objects<br>Traffic and ground surfaces other<br>Other person<br>Other agencies, not elsewhere classified<br>Agency not apparent<br>Agency not known | Other/ unknown transport (incl. pedestrians) | Pedestrian/ Other/ Unknown | | |

Note: Road user group is based on the vehicle that the injured individual was present in/on at the time of injury. For example, "Cars" represents both drivers and occupants of cars, and "Cyclists" represents those who were riding a bicycle at the time of injury.

## Methods

### *Setting*

The state of Victoria, Australia has long-standing, population-based, no-fault, statutory benefit compensation schemes for people injured at work (workers' compensation: WC) or in a transport crash (RTC compensation). Income support, healthcare and other benefits for people injured in RTCs may be provided through either the WC scheme (where the injury occurred during the course of work) or through the RTC compensation system (for non-work-related injury, including travelling to and from work). Both compensation schemes provide payments for treatment and replacement of loss of income when absent from work following injury, for individuals who were employed at the time of injury.

### *Data source*

Data were extracted from the Compensation Research Database (CRD) via the Institute for Safety, Compensation and Recovery Research. By combining two independent compensations systems into one database, the purpose of the CRD is to support research by making claims data available. The CRD includes case level data on all compensated RTC injuries accepted by the WC and RTC compensation schemes in Victoria since 1987 [15]. The database contains detailed information on all claims, payments, services and hospital admissions. The payment datasets contain a single record for each payment made, including income support payments, and this is linked to the individual case file. Thus, there may be multiple payment records per person.

### *Case selection*

This study included working age adults (aged 15–65 years) ([16]) who were injured as a result of a RTC occurring between July 1 2003 and June 30, 2013, and were paid at least one day of income support. Income support payments are only made to injured people who were employed in a paid job at the time of injury and who have been absent from work as a result of their injury. Claims for medical expenses only were excluded.

All cases from the RTC compensation system meeting eligibility criteria were included. Workers' compensation cases meeting inclusion criteria were identified using a combination mechanism of injury and agency of injury fields in the dataset as per VCODE [17]. This is a standardised coding system developed by WorkSafe Victoria for workers' compensation (WC) cases adapted from the Australian standard Type of Occurrence Classification System [18]. Nature of injury and body region were also coded as per VCODE. Table 1 shows the combinations of the mechanism ("overall action, exposure or event which resulted in the most serious injury or disease") and agency ("object, substance, or circumstance which was the direct cause of the most serious injury or disease") of injury fields used for selection [17]. Cases were removed if vital information (e.g. sex, income support data) was missing or if they resulted in fatality. These processes are summarised in Fig. 1.

### *Data harmonisation*

It was feasible to harmonise data fields between datasets for date of injury, age at time of injury, sex, road user group, type of injury and length of hospital stay. The primary injury is coded differently between datasets. For injury type, the WC system uses a standardised coding system that provides more detailed data than the RTC compensation system. A cross match based on injury descriptions was developed which involved collapsing WC injury types to reflect the equivalent RTC compensation system injury

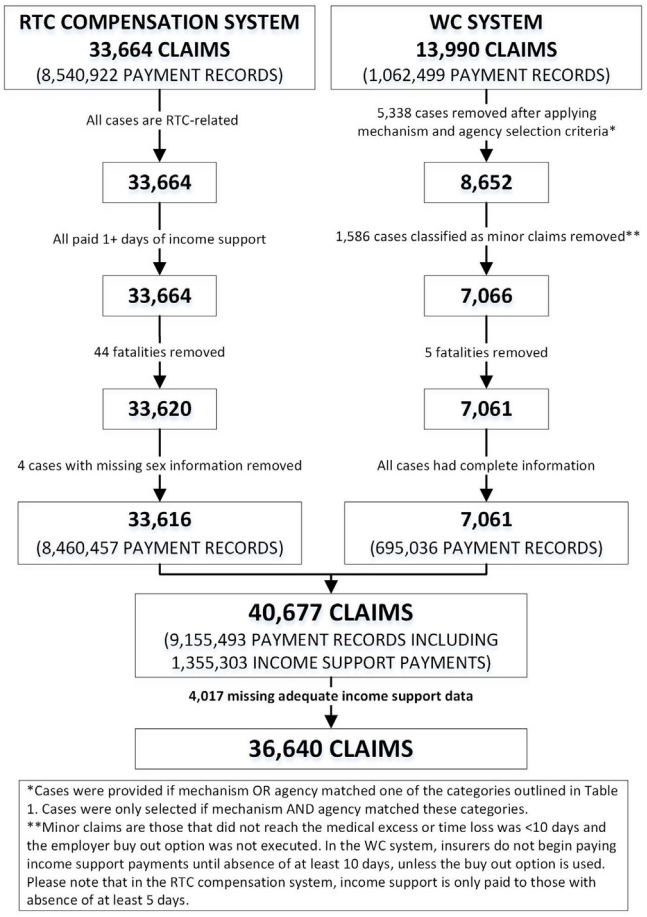


**Fig. 1.** Selection criteria and data harmonisation.

type. These categories were then further collapsed to reduce instances of small cell counts, and to ensure injuries of similar nature were included in the same category (e.g., paraplegia and quadriplegia were combined into a single spinal cord injury category), resulting in 13 categories of injury type (see Table 2 for injury types). Note that each injured individual is assigned only one primary injury type, deemed as such but their case manager, despite potentially exhibiting multiple injuries.

Road user group classification was determined using the coded mechanism and agency of injury (for WC scheme) and the claimant (injured person) role and vehicle insurance class variables (for RTC compensation scheme). Table 1 describes the categorisation matrix developed by the authors. Pedestrians were not specifically coded for the WC cases and hence pedestrians were included in the 'other' category.

Hospitalised cases were identified in the RTC data by variables that indicated the date and length of hospital stay. In the WC data hospitalisation was either recorded in the admissions dataset or inferred from payment data (i.e., if payment had been made for a hospital visit or stay). An acute admission was considered to have occurred if hospitalisation occurred within two days of injury. Length of hospital stay groupings were: no hospital attendance, hospital attendance but no overnight stay, stay of 1–6 days, stay of 7–27 days, or stay of 28 days or more [19].

### *Analysis*

The primary outcome was the duration of work absence, calculated as the number of days compensated. This was calculated using each person's income support data. These data included the

**Table 2**
Description of the cohort.

| | N | % | Median weeks' time loss | IQR |
|---|---|---|---|---|
| **Sex** | | | | |
| Female | 12712 | 34.7 | 8.9 | (2.6-40.1) |
| Male | 23928 | 65.3 | 10.6 | (3.9-34.1) |
| **Age group** | | | | |
| 15-24 years | 7533 | 20.6 | 8.4 | (2.9-26.7) |
| 25-34 years | 8994 | 24.5 | 9.1 | (3.3-31.7) |
| 35-44 years | 8511 | 23.2 | 10.4 | (3.6-39.0) |
| 45-54 years | 7544 | 20.6 | 11.7 | (3.9-44.8) |
| 55+ years | 4058 | 11.1 | 11.9 | (4.0-50.1) |
| **Injury type** | | | | |
| Limb Fracture | 9741 | 26.6 | 12.0 | (5.7-31.1) |
| Whiplash | 6731 | 18.4 | 5.6 | (1.7-30.3) |
| Other Fracture | 3616 | 9.9 | 8.1 | (3.6-25.7) |
| Mild-Moderate Acquired Brain Injury (including concussion) | 3273 | 8.9 | 14.9 | (3.9-58.4) |
| Internal Injury | 2889 | 7.9 | 16.0 | (5.6-59.7) |
| Contusion, Abrasions | 2825 | 7.7 | 3.7 | (1.4-11.9) |
| Sprain, Strains and/or Joint Injury | 2640 | 7.2 | 7.1 | (2.3-23.4) |
| Dislocations | 1596 | 4.4 | 15.6 | (5.9-44.4) |
| Degloving, Open Wound and/or Laceration | 559 | 1.5 | 8.6 | (3.4-28.1) |
| Severe Acquired Brain Injury | 432 | 1.2 | 129.6 | (74.3-154.3) |
| Spinal and/or Nerve Damage | 418 | 1.1 | 29.3 | (6.5-92.1) |
| Spinal Cord Injury | 92 | 0.3 | 115.9 | (58.5-154.7) |
| Other Injuries | 1828 | 5.0 | 8.7 | (2.4-46.7) |
| **Road user type** | | | | |
| Car | 15937 | 43.5 | 9.0 | (2.6-40.9) |
| Motorcycle/scooter | 9184 | 25.1 | 10.9 | (4.9-28.9) |
| Heavy goods vehicle | 3030 | 8.3 | 11.9 | (4.0-51.4) |
| Cyclists | 2040 | 5.6 | 6.6 | (2.3-17.2) |
| Train/tram | 342 | 0.9 | 2.9 | (0.9-12.9) |
| Bus | 157 | 0.4 | 13.6 | (4.9-43.6) |
| Off-road vehicle | 156 | 0.4 | 11.4 | (4.1-36.4) |
| Other/unknown transport | 5794 | 15.8 | 11.9 | (3.9-43.4) |
| **Length of stay** | | | | |
| No hospital attendance | 11729 | 32.0 | 8.1 | (2.9-27.9) |
| Hospital attendance but no overnight stay | 4926 | 13.4 | 4.3 | (1.6-11.0) |
| Hospital stay of 1-6 days | 12995 | 35.5 | 7.9 | (3.0-20.7) |
| Hospital stay of 7-27 days | 4039 | 11.0 | 28.3 | (12.1-76.5) |
| Hospital stay of 28 or more days | 2951 | 8.1 | 78.3 | (36.2-140.6) |
| **Compensation system** | | | | |
| RTC compensation | 32628 | 89.1 | 10.0 | (3.4-35.7) |
| Workers' compensation | 4012 | 10.9 | 10.1 | (2.9-38.1) |
| **TOTAL** | **36640** | **100.0** | **10.0** | **(3.4-36.0)** |

date the payment commenced and finished, and the type of payment made (e.g. full or partial income support). For the purposes of this study, work absence was registered if receiving either full or partial income support, and hence only cessation of all income support was considered to indicate full return to work.

Predictors included sex, age group, injury type, length of stay, road user group and compensation system. For each case, payments were ordered by date and mapped to a matrix representing the type of income support received on each day after the first payment up to 1095 days (or three years), which is the maximum period of time that the RTC compensation system will pay income support [20]. Individuals insured through WC are entitled to income support until 130 weeks, unless they meet certain criteria that allows for longer income support. Thus, for each case it is possible to determine the type of income support received on any day.

The total number of compensated days were summed and divided by seven to calculate number of compensated weeks. The frequency of cases by subgroup was calculated and presented in tabular form along with the median (and interquartile range) number of compensated weeks for each subgroup. Cox regression was used to determine the effect of predictors on work absence. Using Pearson correlation, we determined that no predictors were strongly or significantly correlated as the greatest Pearson correlation coefficient calculated was 0.24. The variable in each category with the highest frequency was selected as the reference (except compensation system). Output was presented as hazard ratios with corresponding 95% confidence intervals. Survival curves were also produced to show duration of income support by length of hospital stay and compensation system.

Analysis was completed using RStudio Version 1.0.153 with R Version 3.4.1. XXX granted ethics approval.

## Results

A total of 36,640 records were analysed, with a combined total of 1,121,863 compensated weeks of working time loss. This represents an average of 30.6 weeks (SD 43.4) per person. Of the total weeks, 990,355.4 weeks were for full payment and 131,507.6 weeks were for partial payment.

### *Description of the cohort*

Table 2 describes the cohort. Males comprised 65.3% of the cohort (n = 23,928). Around a quarter of individuals were aged 25–34 years (n = 8,994, 24.5%) with the eldest age group the least represented (n = 4,058, 11.1%). The largest road user group were those injured in cars (n = 15,937, 43.5%). The most common injury types were limb fracture (n = 9,741, 26.6%) and whiplash cervical spine injuries (n = 6,731, 18.4%). Around a third of injured people

did not require hospital treatment (n = 11,729, 32.0%) and more than half required at least an overnight stay in hospital (n = 19,985, 54.5%). The vast majority of cases were compensated by the RTC compensation scheme (n = 32,628, 89.1%).

*Time loss*

Median weeks' time loss increased with age. Median weeks' work absence was greatest among the most severely injured people, particularly those with severe acquired brain injury (129.6 weeks, 74.3–154.3) and spinal cord injury (115.9 weeks, 58.5–154.7). Road traffic crashes involving train/tram occupants had the lowest median work absence (2.9 weeks, 0.9–12.9) whereas bus occupants had the greatest (13.6 weeks, 4.9–43.6). Those who did not attend hospital for treatment had a higher median time loss than those who attended hospital and stayed less than six days. There appeared to be no major differences in median duration of work absence between compensation systems.

*Cox regression*

Those requiring hospital stays of more than a week were at the greatest risk of prolonged work absence (Fig. 2). Persons with severe acquired brain injury, spinal cord injury, spinal and/or nerve damage and dislocations were also significantly more likely to have prolonged work absence (Table 3). Work absence likelihood increased significantly with age. Work absence was significantly more likely to be of shorter duration among men, cyclists, those involved in a train/tram crash, those treated in hospital without an overnight stay, those receiving compensation through the WC compensation system, and those with contusions, abrasions, degloving, open wound and laceration injuries.

## Discussion

Over a 10-year period in Victoria, Australia, more than 1 million weeks of income support was paid to working age adults injured in RTCs who were compensated through the state WC or RTC compensation systems. This cohort included a variety of road users, and people with different types and severity of injury. Despite not commonly being included in routinely reported road statistics and burden estimates, non-hospitalised injuries made up almost a third of all cases and half of these were absent from work for more than eight weeks following injury. Furthermore, this study describes work absence among hospitalised RTC injury which has not commonly been reported, and adds to understanding of the impacts of RTC. Our findings also provide insight into the characteristics of people who are absent from work for longer periods, information which can support the provision of targeted support (e.g. case management) to reduce work absence and improve engagement in employment after injury.

By far the greatest work absence was observed among those most severely injured, particularly those with severe ABI or spinal cord injury. Individuals with major life altering injuries such as these have consistently been found to take longer to return to work, if at all [21,22]. These findings highlight the major impact of these injuries through diminished functional ability and the importance of prevention and post-injury support. Those with dislocations also had a higher risk of prolonged absence, and are known to have a higher risk of failed return to work attempts [20].

Consistent with previous research of work-related injuries, we observed longer periods of work absence following injury with increasing age [23–25]. Possible explanations include that older adults may have comorbid health conditions (e.g. diabetes, cardiovascular disease) that affect recovery and ability to return to work, or that the biological effects of aging (e.g. slower tissue repair) can impair recovery [23]. Alternatively, poor advice given to older adults to rest as opposed to a gradual return to normal activities may contribute to delayed recovery [26].

Individuals who attended hospital for treatment but did not require admission had a lower risk of work absence compared to those who did not attend hospital. It is possible that some traumatic injuries can be treated immediately without need for monitoring, such as abrasions, lacerations or minor fractures. The present study showed that these injuries carry a significantly shorter duration of work absence. This may also suggest that people with particular injuries have fewer issues returning to normal activities. Additionally, injuries such as whiplash may not present to hospital but may impede the ability to work [27], and in the present study had the same risk of prolonged work absence as limb fracture. This further emphasises to need to look beyond hospitalisation statistics when assessing the burden of road trauma.

Prior studies have found that engagement in injury compensation systems (compensation or litigation) following RTC injury is associated with slower return to work and recovery [28]. Reasons for this could include less incentive to return to work due to income support, the level of compensation benefits provided, or the impact of waiting periods [29,30]. There is some evidence that both limiting initial choice of treating provider, and ability to switch treating providers, influences work absence [31]. There is also emerging evidence that the policies and practices of the compensation system have an effect on duration of work absence [24]. In this study, while the median duration on work absence was very similar between compensation systems, individuals insured through the RTC were more likely to have a longer duration of work absence, once the effect of other covariates (e.g. sex, age) were

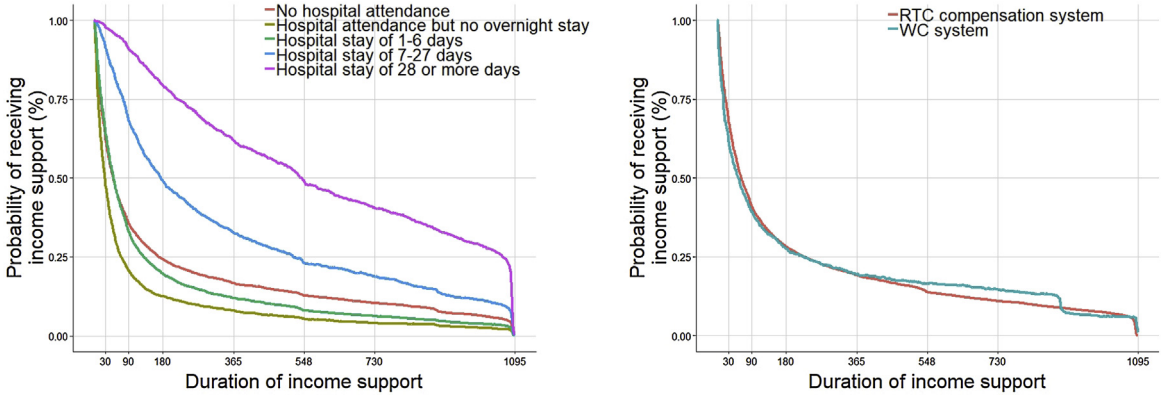


**Fig. 2.** Survival curves showing the duration of income support by length of hospital stay and compensation system.

**Table 3**
Cox regression results.

| | HR | 95% CI | p-value |
|---|---|---|---|
| **Sex** | | | |
| Male | Ref | | |
| Female | 1.04 | (1.02, 1.07) | <0.001 |
| **Age group** | | | |
| 15-24 years | 0.84 | (0.81, 0.86) | <0.001 |
| 25-34 years | Ref | | |
| 35-44 years | 1.13 | (1.10, 1.17) | <0.001 |
| 45-54 years | 1.19 | (1.16, 1.23) | <0.001 |
| 55+ years | 1.19 | (1.15, 1.23) | <0.001 |
| **Injury type** | | | |
| Limb Fracture | Ref | | |
| Whiplash | 1.00 | (0.97, 1.04) | 0.89 |
| Other Fracture | 0.88 | (0.85, 0.92) | <0.001 |
| Mild-Moderate Acquired Brain Injury (including concussion) | 0.93 | (0.89, 0.97) | <0.001 |
| Internal Injury | 0.97 | (0.93, 1.01) | 0.10 |
| Contusion, Abrasions | 0.66 | (0.64, 0.69) | <0.001 |
| Sprain, Strains and/or Joint Injury | 0.89 | (0.85, 0.93) | <0.001 |
| Dislocations | 1.34 | (1.27, 1.41) | <0.001 |
| Degloving, Open Wound and/or Laceration | 0.76 | (0.70, 0.83) | <0.001 |
| Severe Acquired Brain Injury | 1.60 | (1.44, 1.77) | <0.001 |
| Spinal and/or Nerve Damage | 1.39 | (1.26, 1.53) | <0.001 |
| Spinal Cord Injury | 1.56 | (1.26, 1.92) | <0.001 |
| Other Injuries | 1.03 | (0.98, 1.09) | 0.28 |
| **Length of stay** | | | |
| No hospital attendance | 1.04 | (1.01, 1.07) | 0.01 |
| Hospital attendance but no overnight stay | 0.69 | (0.67, 0.72) | <0.001 |
| Hospital stay of 1-6 days | Ref | | |
| Hospital stay of 7-27 days | 1.89 | (1.82, 1.96) | <0.001 |
| Hospital stay of 28 or more days | 2.81 | (2.69, 2.94) | <0.001 |
| **Crash type** | | | |
| Car | Ref | | |
| Motorcycle/Scooter | 0.85 | (0.82, 0.87) | <0.001 |
| Heavy Goods Vehicle | 1.07 | (1.02, 1.11) | <0.01 |
| Cyclist | 0.69 | (0.66, 0.72) | <0.001 |
| Train/Tram | 0.57 | (0.51, 0.64) | <0.001 |
| Bus | 1.12 | (0.96, 1.31) | 0.16 |
| Off-road Vehicle | 0.97 | (0.83, 1.14) | 0.70 |
| Other/unknown transport | 0.97 | (0.94, 1.00) | 0.05 |
| **Compensation system** | | | |
| RTC compensation system | 1.12 | (1.08, 1.17) | <0.001 |
| WC system | Ref | | |

Note: HR < 1 indicates lower risk of prolonged work absence, HR > 1 indicates higher risk of prolonged work absence.

factored into the survival model. This was expected given that employers and injured people have greater obligations with respect to return to work in the WC system and hence return to work is more of a focus of the WC system than the RTC system. The systems also differ in other ways, for example, the WC system is underwritten and regulated by the state Government but case management is provided through five private sector insurers. The RTC compensation system is government owned, is both the regulator and insurer, and provides in-house case management. Thus, the variations in scheme structure and case management, along with differences in the amount and length of income support provided, likely contributes to variations in work absence.

The return to work process typically involves a number of parties, including the injured individual, their family, their employer, healthcare practitioners, and the compensation system. It is the effectiveness of their interactions and coordination that significantly influences the speed and sustainability of return to work, and hence return to work interventions within a single domain have limited effectiveness [32,33]. Studies have shown that it is important for employers to foster the abilities of the injured individuals and provide a supportive and flexible work environment in order to achieve return to work success [34,35]. Flexible arrangements such as allowing a graduated return to work have been found to be successful [36–38]. Furthermore, communication between stakeholders (such as health-care practitioners and employers), initiated by insurance agents, can assist in the development of return to work plans that help to increase the speed and likelihood of return to work [39,40]. Should an injured individual be unable to return to their pre-injury role or require additional assistance and training, compensation systems can provide vocational rehabilitation or workplace modifications. This study has identified those at risk of prolonged work absence (e.g. older individuals, longer hospital stays) and can be used by compensation systems to alter their case management approach to provide tailored support to those that may require extra assistance.

Study strengths include the large data set that encompasses all compensable RTC injuries in Victoria for the study period. There are studies that have examined work absence in either the WC or RTC system independently, yet this is the first known study to combine all compensable RTC injuries to describe work absence across the Victorian population. Variables included in this data set permitted regression analysis that controlled for some covariates known to affect work absence.

Limitations include the use of administrative payment data as the outcome metric, as it is known compensated time loss generally underestimates work absence [41]. The amount of work absence may indeed be longer yet the individual does not qualify for ongoing income support or may receive income elsewhere (e.g. social security, employer-based sick leave). It is possible that the risk of work absence duration was not consistent over the time period, potentially due to changes to Victoria road traffic laws, economic

status of Victoria, or policies and practices of each compensation scheme that affected length or duration of income support and return to work support. Unfortunately, we did not have consistent occupation data between datasets (RTC compensation system data does not capture occupation information) and thus could not determine how occupation or job characteristics may affect duration of absence after RTC injury. Additionally, we used length of hospital stay as a proxy for injury severity, as injury severity information was unavailable in the CRD. Further, administrative data is not collected for the purpose of research and may be subject to data entry errors. Whilst there would be few cases not provided with compensation, it was also not possible to determine differences in work absence between compensable and non-compensable cases of injury. Finally, this study looked at work absence only rather than work functioning, as the use of administrative data prevents analysis of productivity after return to work.

## Conflict of interest

The authors declare they have no conflicting interests.

## Conclusion

Work absence is a measureable and potentially very informative metric for assessing the impact of RTC injury in working age people. Work absence is known to result in loss of income, pre-injury skills, and social connections, and is associated with poorer health outcomes. Findings from this study identified that half of all working adults injured in RTCs in Victoria were absent from work for at least ten weeks, reinforcing the need to focus on road safety, injury prevention, and return to work rehabilitation. Preventing injuries through improved legislation or safer vehicles would help reduce the number of people taking absence from work to recover from their injuries, thereby reducing economic, human and social costs.

Furthermore, this study identified those most at risk of prolonged work absence (e.g. those with spinal cord or severe acquired brain injuries), providing the opportunity to target specific individuals to develop strategies to reduce work absence, such as providing occupation-specific rehabilitation or encouraging a graduated return to work. Compensation systems for those injured in RTCs exist in most parts of the world and hence this metric is potentially applicable across many jurisdictions.

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